



Cassava mosaic disease

Cassava mosaic geminiviruses



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Advanced mosaic and distortion of leaves on an infected cutting.



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Although chlorotic (yellow) areas are well developed the limited leaf distortion suggests infection via whiteflies after planting.

SUMMARY: Cassava mosaic disease (CMD) is widespread, occurring in all countries in Africa where cassava is grown. This viral disease has been present in Africa for over a hundred years yet caused relatively little concern until the 1980s, when an outbreak of a damaging epidemic began in Uganda and now affects all neighbouring countries. The disease is spread in cuttings, which may be symptomless, and by whiteflies. Disease management has concentrated on the use of resistant cultivars. While this is an important strategy to reduce yield losses, more attention should be paid to the use of clean planting material, early detection of CMD in fields and removal of plants.

KEY SIGNS

The main symptoms of CMD are patches of discoloured (chlorotic) areas on leaves, which vary from light green to yellow, accompanied by distortion of leaves, often severe. CMD symptoms are readily detected in the field though symptomless infections also occur. Mosaic symptoms vary greatly in overall pattern and intensity depending on the strain of virus, susceptibility of cassava cultivars and growing conditions. The more extensive the development of leaf symptoms, the greater the overall reduction in plant growth and yield.

Two types of mosaic have been noted: yellow mosaic shows a strong contrast between the discoloured areas and healthy tissue; in green mosaic the colour changes in leaves are less intense and the border with healthy leaf areas less distinct. The leaf distortion occurs because the chlorotic areas expand less rapidly. Leaf stalks may also be affected and have a characteristic S-shape, though this is not a key symptom.

In severe infections leaves fall off while tubers continue to show no obvious symptoms. However, the effect of CMD on tuber production is often profound, with fewer, smaller and even no tubers produced. Rotting is due to secondary diseases, such as *Armillaria*, a widespread fungus, in plants already severely affected and weakened by CMD.

Cassava mosaic geminiviruses (CMGs) are spread in cuttings and by whiteflies. The first and subsequent leaves from infected cuttings show characteristic mosaics and distortion. Mother plants selected for cuttings may show little or no evidence of CMD. Healthy cassava cuttings also become infected by whiteflies carrying the virus but do not show symptoms for some time.

CMD symptoms can be confused with green mite feeding damage. This feeding results in a speckling of the leaf surface and some distortion, though much less pronounced than CMD. The damage caused by the mites develops more uniformly in groups of plants compared to the greater variation in CMD development.

MANAGEMENT

Prevention – what to do before signs are seen

Cultural approaches: CMD is an internal disease: the virus lives in the host, where it multiplies and spreads, disrupting development and reducing growth and yields. There are no treatments for virus-infected plants, hence the importance of selecting material for propagation from a reliable and disease-free source. Particular attention should be given to training extension workers, farmers and others involved in sourcing healthy cuttings for propagation.

CMD-resistant cultivars are widely available. Their acceptability to farmers will depend on an overall assessment of other key crop characteristics. Extension services and research organisations are the best source of advice on resistant cultivars and how to obtain them. Extra care is needed in selection of planting material following the spread of another cassava virus disease, cassava brown streak disease (CBSD), beginning in the early 2000s in East Africa. Many of the CMD-resistant cultivars are, unfortunately, susceptible to CBSD.

Chemical approaches: Vector control is complicated by the difficulty in killing enough insects quickly (and regularly) to limit the spread of CMD in fields. The cost of chemicals and labour is likely to be high and difficult to afford for poor farmers. The reported 'super-abundance' of whitefly populations in Uganda raises further barriers to effective vector control.

There are no proven biocontrol options and preventing movement of whiteflies from infected areas is next to impossible. The overall conclusion is that vector control offers few if any benefits in managing CMD.

Control – what to do after signs are seen

Cultural approaches: Removal of diseased plants from fields is part of an integrated strategy for managing CMD. This is only effective if done early, before many plants are affected.

CAUSE

There are 8-9 cassava virus species which cause CMD. All are geminiviruses and share similar characteristics, though they interact with cassava in different ways. All cassava geminiviruses (CMGs) are closely related. Some have distinct common names, such as *African cassava mosaic virus* and *East African cassava mosaic virus*, reflecting particular patterns of disease attack.

CMD was of relatively minor importance until the 1980s, when a significant epidemic began in Uganda. CMGs are constantly changing with new variants favouring niches that existing types are unable to survive in.

IMPACT

Cassava infected by CMD is readily visible throughout East Africa, yet the full impact of the disease on yields may not always be fully appreciated. Reduction in tuber production has a profound impact on farmers who depend on a crop which is a traditional bulwark against drought and famine. Loss of cassava leaves is also important where they are a traditional food.

The contiguous production of cassava across Uganda, Tanzania, Kenya and beyond has allowed new and more damaging virus strains to spread rapidly. Coordinated actions by extension services and farmers over large areas are essential to detect new outbreaks and limit disease spread.

Changes in the behaviour, biology and abundance of whiteflies have also been important in increasing the impact of CMD in eastern Africa.

DISTRIBUTION

CMD is present in all countries in Africa that grow cassava, from Senegal to South Africa and also on island nations such as Seychelles and Madagascar. CMD also occurs in India and Sri Lanka.

FURTHER READING

Plantwise Knowledge Bank (www.plantwise.org).

Crop Protection Compendium (www.cabi.org/cpc)

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